REMARKS:

This is a preliminary amendment to the present application. Applicants amend claims 1, 3, 5, 9, 10, 14, 17-18, and 20-22 of the applicant; marked up versions of the amended claims are attached hereto pursuant to 37 C.F.R. § 1.121(c)(ii). Pursuant to this amendment, claims 1-22 are pending. Reexamination and reconsideration of the application are respectfully requested.

In the Final Office Action dated August 13, 2001, the Examiner indicated that claims 9, 14, 17-18, and 20-22 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants amend claims 9, 14, 17-18, and 20-22 to become independent form including all of the limitations of their respective base claims. As such, applicants respectfully submit that claims 9, 14, 17-18, and 20-22 are in condition for allowance.

The Examiner rejected claims 1-4 as anticipated by U.S. Patent No. 5,589,406 to Kato *et al.* The Examiner rejected claims 5-8, 10-13, 15-16, and 19 as obvious over the Kato patent in view of U.S. Patent No. 6,037,924 to Koyama *et al.* All rejections are respectfully traversed. Applicants, however, amend claims 1, 3, 5, and 10 only to better clarify aspects of the present invention and submit that all pending claims are in condition for allowance.

The present applicant describes a display device having a plurality of semiconductor elements so arranged in the display device for alleviating deterioration of display characteristics of the display device associated with a laser annealing process upon the display device. In one embodiment of the present invention shown in FIG. 9, the presently described display device includes, in the driver area 3 or 4, sampling TFTs 6 functioning as transfer gates in which their respective N-channel areas and P-channel areas are integrally formed. The channel region CH of each such TFT in the driver area has an elongated configuration where ***its channel width is sufficiently larger than its channel length***. Moreover, ***the longitudinal direction of the TFT's elongated channel region CH is arranged obliquely relative to both the vertical direction V and the***

horizontal direction H of the substrate. For instance, the longitudinal direction of the elongated channel region CH has an angle of approximately 45° relative to the vertical direction V or the horizontal direction H of the substrate. See Application, FIG. 9 and page 20, line 21-page 21, line 18.

The excimer laser beam used for annealing the present display device is irradiated on the substrate extending along the vertical direction V or the horizontal direction H. Specifically, the side direction of the substrate 1 is generally the same as the major-axis direction and/or the minor-axis direction of the defective crystallized regions R. See Application, FIGS. 8 and 9, page 27, line 24-page 28, line 2. As a result, the defective crystallized regions R will pass on only a part of the oblique channel regions CH of some of the TFTs. The presently described display device's display characteristics will, therefore, not be greatly deteriorated. See Application, page 28, lines 3-18.

The Kato patent, on the other hand, describes a method of making a TFT display device having a plurality of row and column pixel-drive-TFTs each having a polycrystalline channel and respectively arranged in a line-like form corresponding to pixel electrodes arranged in a matrix form. The Kato patent, however, never teaches or suggests that the channel width direction of the driver transistors is ***different from (such as neither vertical to nor parallel with) a side direction of the substrate of the display device***. Nor does that patent describe a channel width direction of the sampling TFT's channel region is formed in ***a direction different from a major-axis direction and a minor-axis direction of a laser-beam used to anneal the display device***.

The Kato patent instead teaches that the TFT driver transistors of the row driver circuits 6 are disposed ***on the same line as the transistors for picture display*** and the TFT driver transistors of the column driver circuits 7 are disposed ***on the same column as the transistors for picture display***. See FIG. 4, column 8, lines 40-44 of the Kato patent. Moreover, the scanning for laser beam annealing is conducted in the direction of row electrode line of the Kato device and ***is parallel to the upper and lower sides of the substrate***. See column 8, lines 29-31

thereof. It is clear that the driver circuit transistors of Kato's display device are arranged in essentially the same way as those of a conventional TFT display device shown in FIG. 2 of the present application. Thus, the display device described in the Kato patent will experience the same difficulties to which that the conventional TFT LCD device would have faced. Accordingly, the present application distinguishes over the Kato patent.

In page 5 of the outstanding Final Office Action, the Examiner stated that "Kato does teach the channel width direction of the driver transistors differs from the side directions of the substrate of the display device or from the longitudinal and/or short axial directions of the laser beam used to anneal the display device (col. 5, lines 26-53) and (Fig. 7, col. 7, lines 16-51)." Applicants respectfully disagree.

The Kato patent describes a display device shown in its Fig. 7 with row driver circuits 6 and column driver circuits 7 connected to pixel region 5, respectively. However, "[t]hese TFTs are arranged in a substantially line-like form ***in the direction parallel to the row electrode lines.***" See col. 7, lines 27-28 of the Kato patent. Accordingly, the channel width direction of the column driver transistors 7 will be parallel to (i.e., the same as) the vertical side direction of the substrate. In addition, the laser beam used for annealing the display device is irradiated on the horizontal direction (i.e., the numeral 4 direction) of the substrate. See FIG. 7, col. 7, lines 30-31 thereof. Thus, the scanning direction (i.e., the minor-axis direction) of the laser beam falls on the vertical side direction of the substrate. And the channel width direction of the column driver transistors 7 is parallel to (i.e., the same as) the scanning direction of the laser beam. In this aspect, the Kato's display device shown in FIG. 7 is essentially the same as the conventional display device. Therefore, the Kato patent does not teach or suggest the above-mentioned aspects of the present invention.

Likewise, aspects of the present invention distinguish over the Koyama patent. The Koyama patent describes a matrix type liquid-crystal display unit having a plurality of first thin-film transistors (TFTs) that form the signal-line drive circuit and a plurality of second thin-film transistors (TFTs) that form the

scanning-line drive circuit. According to the Koyama patent, its matrix-type LCD display unit includes a threshold value control circuit connected to the drive circuit for controlling the threshold voltage of the TFTs by applying a voltage to the control terminal of each TFT. See col. 3, lines 10-12 thereof. As a result, the power consumption of the drive circuit is reduced and the operating frequency of the drive circuit is improved. The Koyama patent, however, does not teach or suggest that a channel width direction is formed in a direction different from a side direction of said substrate. Nor does that patent describe that a channel width direction of the sampling TFT's channel region is formed in a direction different from a major-axis direction and a minor-axis direction of a laser-beam used to anneal the display device.

Claim 1 of the present application recites, in pertinent part, "in some or all of said semiconductor elements, a channel width of a channel region formed in a semiconductor layer to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is neither vertical to nor parallel with regard to a side direction of said substrate". As discussed, the Kato patent does not describe this limitation of claim 1. Thus, claim 1 distinguishes over the Kato patent and is in condition for allowance.

Claim 2 depends on claim 1. Thus, claim 2 similarly distinguishes over the Kato patent and is in condition for allowance.

Claim 3 recites, in pertinent part, "in some or all of said semiconductor elements, a channel width of a channel region formed in a semiconductor layer to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing". As discussed, the Kato patent does not describe this limitation of claim 3. Thus, claim 3 distinguishes over the Kato patent and is in condition for allowance.

Claim 4 depends on claim 3. Thus, claim 4 similarly distinguishes over the Kato patent and is in condition for allowance.

Claim 5 recites, in pertinent part, "in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is neither vertical to nor parallel with regard to a side direction of said substrate". As discussed, neither the Kato patent nor the Koyama patent describes this limitation of claim 5. Thus, claim 5 distinguishes over the Kato patent and the Koyama patent and is in condition for allowance.

Claims 6-8 depend on claim 5. Thus, claims 6-8 similarly distinguish over the Kato patent and the Koyama patent and are in condition for allowance.

Claim 9 is amended to become independent form. Thus, applicants submit that claim 9 is in condition for allowance.

Claim 10 recites, in pertinent part, "in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing". As discussed, neither the Kato patent nor the Koyama patent describes this limitation of claim 10. Thus, claim 10 distinguishes over the Kato patent and the Koyama patent and is in condition for allowance.

Claims 11-13 depend on claim 10. Thus, claims 11-13 similarly distinguish over the Kato patent and the Koyama patent and are in condition for allowance.

Claim 14 is amended to become independent form. Thus, applicants submit that claim 14 is in condition for allowance.

Claim 15 recites, in pertinent part, "in some or all of said plurality of second thin-film transistors, a channel width being larger than a channel length, and a channel width direction of some or all of second thin-film transistors being formed non-parallel with and non-orthogonal to a channel width direction of said first thin-film transistors". As discussed, neither the Kato patent nor the Koyama patent describes this limitation of claim 15. Thus, claim 15 distinguishes over the Kato patent and the Koyama patent and is in condition for allowance.

Claim 16 depends on claim 15. Thus, claim 16 similarly distinguishes over the Kato patent and the Koyama patent and is in condition for allowance.

Claims 17-18 are amended to become independent form. Thus, applicants submit that claims 17-18 are in condition for allowance.

Claim 19 depends on claim 15. Thus, claim 19 similarly distinguishes over the Kato patent and the Koyama patent and is in condition for allowance.

Claims 20-22 are amended to become independent form. Thus, applicants submit that claims 20-22 are in condition for allowance.

The art made of record but not relied upon by the Examiner has been considered. However, it is submitted that this art neither describes nor suggests the presently claimed invention.

Applicant believes the foregoing amendments place the application in condition for allowance and early, favorable action is respectfully solicited.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles telephone number (213) 337-6870 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,

HOGAN & HARTSON L.L.P.

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Version with markings to show changes made:

1. (Amended) A semiconductor device in which a plurality of semiconductor elements are formed on a substrate, wherein

in some or all of said semiconductor elements, a channel width of a channel region formed in a semiconductor layer to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is [formed in a direction different from] neither vertical to nor parallel with regard to a side direction of said substrate.

3. (Amended) A semiconductor device in which a plurality of semiconductor elements are formed on a substrate, wherein

in some or all of said semiconductor elements, a channel width of a channel region formed in a semiconductor layer to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and [and/or] a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing.

5. (Amended) A display device, comprising:[,]

a plurality of pixel electrodes arranged on a substrate;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating pixels to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors, wherein

in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is

[formed in a direction different from] neither vertical to nor parallel with regard to a side direction of said substrate.

9. (Amended) [The] A display device [according to claim 5], comprising:

a plurality of pixel electrodes arranged on a substrate;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating pixels to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors, wherein

in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a side direction of said substrate, and

said channel width direction of said some or all of second thin-film transistors is set to a direction of about 45° relative to any one or all of a plurality of side directions of said substrate.

10. (Amended) A display device, comprising:[,]

a plurality of pixel electrodes arranged on a substrate;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating pixels to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors, wherein

in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing

is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and [and/or] a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing.

14. (Amended) [The] A display device [according to claim 10], comprising:

a plurality of pixel electrodes arranged on a substrate;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating pixels to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors, wherein

in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and/or a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing, and

said channel width direction of said some or all of second thin-film transistors is set to a direction of about 45° relative to the major-axis direction and/or the minor-axis direction of said laser-beam irradiated region.

17. (Amended) [The] A liquid crystal display device [according to claim 15], comprising:

a plurality of pixel electrodes arranged on one of a pair of substrates holding a liquid crystal therebetween;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating the liquid crystal to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors,

channel regions of said plurality of first and second thin-film transistors being formed in a semiconductor film to which laser annealing is applied, and

in some or all of said plurality of second thin-film transistors, a channel width being larger than a channel length, and a channel width direction of some or all of second thin-film transistors being formed non-parallel with and non-orthogonal to a channel width direction of said first thin-film transistors,

wherein

among said plurality of second thin-film transistors, said some or all of second thin-film transistors in which the channel width direction is formed non-parallel with and non-orthogonal to the channel width direction of said first thin-film transistors

are used, in said display drive circuit, as sampling transistors for sampling video signals at a predetermined timing and supplying said display signals to the corresponding plurality of first thin-film transistors.

18. (Amended) [The] A liquid crystal display device [according to claim 15], comprising:

a plurality of pixel electrodes arranged on one of a pair of substrates holding a liquid crystal therebetween;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating the liquid crystal to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors,

channel regions of said plurality of first and second thin-film transistors being formed in a semiconductor film to which laser annealing is applied, and

in some or all of said plurality of second thin-film transistors, a channel width being larger than a channel length, and a channel width direction of some or all of second thin-film transistors being formed non-parallel with and non-orthogonal to a channel width direction of said first thin-film transistors,

wherein

said display drive circuit comprises:

a video signal line to which the video signals are supplied from outside, sampling transistors for sampling the video signals from said video signal line at a predetermined timing and supplying said display signals to the corresponding plurality of first thin-film transistors, and a shift register for controlling switching operation of said sampling transistors,

and wherein, among said plurality of second thin-film transistors, said some or all of second thin-film transistors in which the channel width direction is formed non-parallel with and non-orthogonal to the channel width direction of said first thin-film transistors

are used in said sampling transistors and the shift register.

20. (Amended) [The] A liquid crystal display device [according to claim 15], comprising:

a plurality of pixel electrodes arranged on one of a pair of substrates holding a liquid crystal therebetween;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating the liquid crystal to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors,

channel regions of said plurality of first and second thin-film transistors being formed in a semiconductor film to which laser annealing is applied, and

in some or all of said plurality of second thin-film transistors, a channel width being larger than a channel length, and a channel width direction of some or all of second thin-film transistors being formed non-parallel with and non-orthogonal to a channel width direction of said first thin-film transistors,

wherein

said channel width direction of the channel region of said some or all of second thin-film transistors is set to a direction of about 45° relative to the channel width direction of said first thin-film transistors.

21. (Amended) [The] A display device [according to claim 10], comprising:

a plurality of pixel electrodes arranged on a substrate;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating pixels to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors, wherein

in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and/or a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing, and

the channel width of some or all of said plurality of second thin-film transistors is formed neither parallel with nor orthogonal to a channel width direction of said plurality of first thin-film transistors.

22. (Amended) [The] A display device [according to claim 12], comprising:

a plurality of pixel electrodes arranged on a substrate;

a plurality of first thin-film transistors connected to corresponding pixel electrodes among said plurality of pixel electrodes for supplying signals for operating pixels to the connected pixel electrodes; and

a plurality of second thin-film transistors constituting a scanning drive circuit for scanning said plurality of first thin-film transistors and/or a display drive circuit for supplying display signals to said plurality of first thin-film transistors, wherein

in some or all of said plurality of second thin-film transistors, a channel width of a channel region formed in a semiconductor film to which laser annealing is applied is larger than a channel length thereof, and a channel width direction is formed in a direction different from a major-axis direction and/or a minor-axis direction of a laser-beam irradiated region at the time of application of said laser annealing,

the channel width of some or all of said plurality of second thin-film transistors is formed neither parallel with nor orthogonal to a channel width direction of said plurality of first thin-film transistors, and

said display drive circuit comprises:

a video signal line to which the video signals are supplied from outside, sampling transistors for sampling the video signals from said video signal line at a predetermined timing and supplying said display signals to the corresponding plurality of first thin-film transistors, and a shift register for controlling switching operation of said sampling transistors,

and wherein, among said plurality of second thin-film transistors, said some or all of second thin-film transistors in which the channel width is larger than the

channel length and the channel width direction is formed in a direction different from the major-axis direction and/or the minor-axis direction of said laser beam irradiated region are used in said sampling transistors and the shift register.